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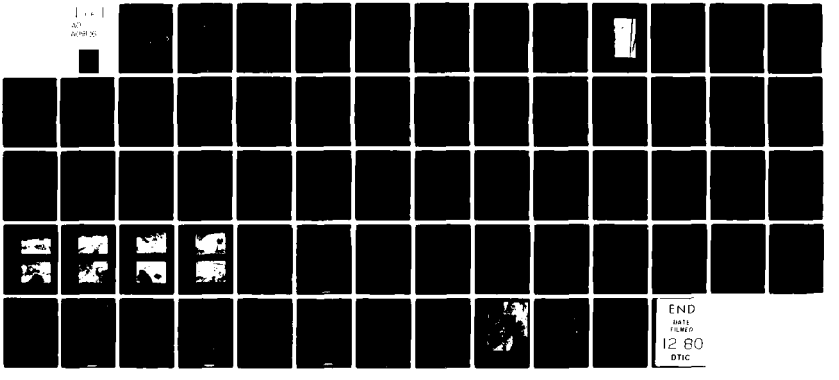

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PATAPSCO RIVER BASIN
GWYNNS RUN, BALTIMORE CITY

MARYLAND

PECK'S BRANCH DAM

NDI ID NO. MD-23

CITY OF BALTIMORE

LEVEL II

AD A091260

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

DACW31-80-C-0050

By
RUMMEL, KLEPPER & KAHL
Consulting Engineers
Baltimore, Maryland 21202

JULY 1980

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(10) Edward S. / Zeigler

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PATAPSCO RIVER BASIN
GWYNNS RUN, BALTIMORE CITY
MARYLAND

(6) National Dam Inspection Program

PECK'S BRANCH DAM
NDI-ID ~~NO.~~ MD-23

Number

CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(11) Jul 80 (12) 64

Prepared for:
DEPARTMENT OF THE ARMY
Baltimore District Corps of Engineers
Baltimore, Maryland 21203

(15) DACW31-80-C-0050

By:
RUMMEL, KLEPPER & KAHL
Consulting Engineers
1035 N. Calvert Street
Baltimore, Maryland 21202

July 1980

411913

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

PATAPSCO RIVER BASIN

GWYNNS RUN, BALTIMORE CITY
MARYLAND

PECK'S BRANCH DAM
NDI ID NO. MD-23

CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

July 1980

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION
AND RECOMMENDED ACTION

Name of Dam:	Peck's Branch Dam NDI ID No. MD-23
Size:	Intermediate (55 feet high, 141 acre-feet)
Hazard Classification:	High
Owner:	City of Baltimore Department of Public Works 600 Municipal Office Building Baltimore, Maryland 21202
State Located:	Maryland
City Located:	Baltimore
Stream:	Gwynns Run
Dates of Inspection:	May 29, 1980 and July 15, 1980

Based on the visual inspection, available records, past operational performance, and in accordance with the guideline criteria established for these studies, Peck's Branch Dam is judged to be in poor condition.

The dam impounds wash water generated at the Ashburton Water Purification Plant. The wash water flows from the plant by gravity into the impoundment through a 42 inch diameter pipe. The level of the wash water lake is maintained between elevation 304 and 308 by controlling the upper level gate on the drop inlet spillway located near the southern embankment of the dam. The overflow is discharged into Gwynns Run through a 10 foot by 9.75 foot semi-elliptical drain.

Except for rainfall on the wash water lake surface and a small amount of surface water runoff from the northern end of the lake, the only inflow into the lake is from the water purification plant, and therefore, flood routing analyses are not required.

With the exception of the three seepage areas described in the next paragraph, no stability problems were evident for the embankment or the appurtenant structures at the time of the visual inspection.

Three zones of seepage were noted along the southern embankment of the dam during the visual inspection. One seepage is located along the left side of the semi-elliptical drain, apparently flowing along the drain. The estimated flow rate of the seepage was 5 gallons per minute. The second seepage zone is located near the right abutment of the dam

near the toe. It is not apparent whether the seepage is originating from the wash water lake, from Lake Asburton to the west, or from another source. The estimated flow rate of this seepage was 15 gallons per minute. The third seepage was noted approximately 20 feet right of the semi-elliptical drain at the toe of the slope. The exact source of the seepage was not evident, and there was no measurable flow. The first two seepages were noted by employees of the Ashburton Water Purification Plant as early as 1977. None of the three seepages appears to be carrying any fines with it. However, the flow rate of the seepage near the right abutment, and the presence of the seepage areas adjacent to the semi-elliptical drain, are of sufficient importance to question the potential for internal erosion and piping within the embankment, with the resultant decrease in embankment stability.

The following remedial measures should be accomplished immediately by the Owner.

1. Retain the services of a Registered Professional Engineer experienced in the design and construction of embankment dams to investigate the three observed seepage areas, to determine the source of the seeps, and to recommend corrective measures that will eliminate or control the seepage.

2. Retain the services of a Registered Professional Engineer experienced in the design and construction of embankment dams to evaluate the need to remove the trees having diameters greater than 4 inches that are growing on the embankment. If removal is recommended, the P.E. should also recommend a method of root removal and refill to prevent the formation of voids in the embankment caused by root decomposition.

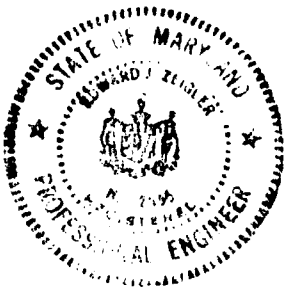
3. The brush, woody vegetation, and small trees growing on the embankment slopes should be removed, and future growth controlled.

4. Schedule formal periodic inspections of the dam embankment and appurtenant structures.

5. Develop a formal warning system to alert downstream residents in the event of emergencies.

Submitted by:

KIMMEL, KLEPPER & KAHL



Edward J. Zeigler, P.E.
Associate

Date: August 31, 1978

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 22 Sep 1978

PECK'S BRANCH DAM

AN OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PECK'S BRANCH DAM
NDI ID NO. MD-23

SECTION I
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the dam inspection program is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of the Project.

a. Dam and Appurtenances. Peck's Branch Dam is the impoundment for wash water discharged from the Ashburton Water Purification Plant. The perimeter of the impoundment is approximately 2050 feet as measured along the fence surrounding the wash water lake. Of the 2050 feet, approximately 1500 feet is an embankment extending above the original ground line. The embankment is approximately 55 feet high at its maximum section along the southern side of the impoundment. The southern and southeastern embankments of the dam were constructed over an existing rock fill embankment.

Overflow from the lake is controlled by the drop inlet spillway at the southern end of the lake which discharges into a 9.75' x 10' semi-elliptical drain. The drain discharges directly into Gwynns Run. The normal water level of the lake ranges between elevations 304 and 308. Because essentially all significant inflow to the lake is from the Ashburton Water Purification Plant, detailed hydraulic and hydrologic analyses have not been performed.

The various features of the dam and impoundment are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is included in Appendix F.

b. Location. Peck's Branch Dam is located between the Ashburton Water Purification Plant and the reservoir which retains filtered water from the plant, Lake Ashburton. The wash water lake is shown on U.S.G.S. Quadrangle, Baltimore West, Maryland, at latitude N39°19'12" and longitude W76°40'06". A location map is included as Plate E-1.

c. Size Classification. Intermediate (55 heet high, 141 acre feet).

d. Hazard Classification. High Hazard. A dense residential area is located downstream of the dam, just downstream of the inlet to the Gwynns Run culvert at Gwynns Falls Parkway. In the event of a dam failure, the residential area could be flooded if the culvert became obstructed and could not handle the flood water

e. Ownership. City of Baltimore, Department of Public Works, 600 Municipal Building, Baltimore, Maryland 21202.

f. Purpose of Dam. Disposal area for water purification plant wastewater.

g. Design and Construction History. According to Contract Drawings dated June 1953, the dam was designed for the City of Baltimore, Department of Public Works by Whitman, Requardt and Associates. Records indicate that dam construction was completed in 1956, however no information concerning the construction contractor or the degree of construction supervision is available.

h. Normal Operating Procedure. Wash water is discharged into the lake from the Ashburton Water Purification Plant through a 42 inch pipe. The only other water entering the lake is precipitation falling directly on the lake and a minor amount of surface runoff.

The pool level of the wash water lake is normally maintained between elevations 304 and 308 by the drop inlet spillway at the southern end of the lake. The pool level may be lowered by adjusting a manually operated gate at the overflow structure. The gate is operated an average of 3 or 4 times a month, and it is reported to function satisfactorily.

1.3 Pertinent Data.

a. Drainage Area. Not applicable.

b. Discharge at Dam Site. Not applicable.

c. Elevation (Baltimore City Datum)(Feet).

Top of Dam	312.9 (low point)
Maximum Pool	310 (overflow)
Normal Pool	304
Upstream Invert Outlet Works	258.76
Downstream Invert Outlet Works	254.24
Streambed at Centerline of Dam	270±
Maximum Tailwater	Unknown
Downstream Toe	258±

d. Reservoir Length.

Normal Pool Level	660± feet
Maximum Pool Level	680± feet

e. Storage (Acre-Feet).

Normal Pool Level	89
Maximum Pool Level	123
Top of Dam	141

f. Reservoir Surface (Acres).

Normal Pool Level	5.1
Maximum Pool Level	5.7
Top of Dam	6.0

g. Dam.

Type	Earth and Rockfill
Volume of Fill	115,000 cubic yards
Length	1500± feet
Height	55± feet (maximum)
Top Width	20± feet (minimum) 60± (Dukeland St.)
Side Slopes	Downstream: 1 Vertical to 2 Horizontal Upstream: 1 Vertical to 3 Horizontal
Zoning	Yes
Impervious Core	None
Cutoff	None
Grout Curtain	None

h. Regulating Outlet.

Type	Overflow structure into 9.75' x 10' semi elliptical drain.
Length	240 feet
Closure	Two Manually Operated Sluice Gates (upper and lower)
Access	Concrete walkway from crest of Southern Embankment
Regulating Facilities	Overflow Structure

i. Spillway.

Type	Drop Inlet Spillway
Location	Near upstream toe of southern embankment
Crest Elevation	313
Length	29 feet
Number Type of Gates	Two Manually Operated Sluice Gates (upper and lower)

SECTION 2
DESIGN DATA

2.1 Design.

a. Data Available. Contract Drawings for the construction of Peck's Branch Dam dated June 1953 have been used for our analyses. A limited amount of correspondence regarding construction of the soil cement layer on the upstream slope of the embankment is available.

(1) Hydrology and Hydraulics. No hydrologic and hydraulic analyses are available. The contract drawings include a "Reservoir Storage Capacity vs. Pool Elevation" curve.

(2) Embankment. A typical section of the embankment indicating the use of a 4 foot thick soil cement slab on the upstream slope and construction of an 18 inch concrete wall at the upstream toe is included as Plate E-2.

(3) Appurtenant Structures. The contract drawings include as-built drawings of the overflow structure and semi-elliptical drain.

b. Design Features.

(1) Embankment. Based on the contract drawings, the earth embankment surrounds 1500± feet of the wash water lake and reaches a maximum height of 55 feet above original ground surface. The southern and southeastern portions of the embankment are constructed on top of a previously constructed rockfill embankment. The embankment was constructed across a valley cut by Gwynns Run, which was formerly Peck's Run. The minimum crest width is 20 feet and the width increases to 60 feet where the embankment serves as the berm of Dukeland Street. The top 4 feet of the upstream slope is a soil cement slab, and an 18 inch thick concrete wall is constructed at the upstream toe of the embankment. Grouted riprap slope protection was constructed between elevation +309 and elevation +311.

(2) Appurtenant Structures. The appurtenant structure for the dam consists of the drop inlet spillway and the semi-elliptical drain. Specific design information is shown on the contract drawings.

c. Design Data.

(1) Hydrology and Hydraulics. No design data is available. A tabulation of reservoir storage vs. elevation has been derived from information contained on the contract drawings.

(2) Embankment. A typical section of the embankment was shown on the contract drawings and is included in Appendix E.

2.2 Construction. No data is available on the construction of the dam with the exception of correspondence describing construction of the soil cement slab on the upstream slope.

2.3 Operation. The only formal records maintained by the City of Baltimore are records of the mechanical and electrical equipment.

2.4 Other Investigations. The City of Baltimore retained the engineering firm of Purdum and Jeschke of Baltimore, Maryland, to inspect the Gwynns Run Diversion culvert which carries Gwynns Run underground from the Gwynns Falls Parkway to Gwynns Falls. The culvert inlet is approximately 2000 feet downstream of Peck's Branch Dam. A copy of the Purdum and Jeschke report entitled, "Gwynns Run Diversion Culvert Reconnaissance Report," dated June 1980 has been reviewed. Based on their inspection, the culvert is generally in good condition, and no conditions exist with would obstruct or otherwise adversely affect flow through the culvert.

2.5 Evaluation.

a. Availability. The design information is limited to the contract drawings for the dam.

b. Adequacy. The available design documents lack such considerations as embankment slope stability, seepage analysis, and other quantitative data to aid in evaluating the adequacy of design.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The on-site inspection of Peck's Branch Dam consisted of:

(1) Visual inspection of the embankment, abutments and embankment toe.

(2) Visual examination of the appurtenant structures.

(3) Evaluation of the downstream area hazard potential.

The specific observations are shown on Plate A-1.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features. The inspection of the downstream embankment slopes, particularly the southern (i.e. highest) embankment, was difficult because of the density of vegetation. The slopes are covered with brush, shrubs, and trees which have diameters up to 6 inches.

Three seepage areas were noted near the downstream toe of the southern embankment. One seep, flowing at an estimated rate of 5.0 gallons per minute, flows from the ground at a point near the top of the left side of the semi-elliptical drain which connects with the drop inlet spillway of the dam. The water flowing from the ground is clear, and no deposit of sediment was noted downstream of the seepage. The second seepage zone is located near the right abutment of the dam near the toe. The seepage is referred to as a zone because it does not flow from the ground at a single identifiable source. The estimated rate of flow is from 10 to 15 gallons per minute. Like the water flowing from the other seep, the water is clear and no deposits of sediment were noted downstream. Flow from the seepage zone has eroded a small channel approximately 3 feet wide, and the water enters Gwynns Run approximately 80' right of the semi-elliptical drain. It is not apparent whether the seepage is originating from the wash water lake, Lake Ashburton to the west, or from another source. Both seepage areas were noted by personnel of the Ashburton Water Purification Plant as early as 1977. The third zone of seepage was noted near the toe of the dam approximately 20 feet right of the semi-elliptical drain. The seepage rate was so low that it was not measurable, and the source of the seep could not be positively identified.

The crest of the dam was surveyed and the variance in elevation was 11 inches between the high and low point. Also, the low point on the crest is 1.2 inches below the design crest elevation of the dam which is +313. Freeboard at the time of the inspection was approximately 7 feet. The dam crest profile is included as Plate E-3.

c. Appurtenant Structures. The drop inlet spillway and the semi-elliptical drain were noted to be in satisfactory condition at the time of the inspection. It should be noted that personnel of the Ashburton Water Purification Plant inspected the drain in 1979 and found it to be in satisfactory condition. The upper level gate of the overflow structure is used an average of 3 or 4 times a month to control the water level in the wash water lake and, according to plant personnel, it functions adequately. The lower level gate is, according to plant personnel, operable, but is is covered with plant sludge and it has not been opened for at least two years.

d. Reservoir Area. With the exception of rain falling directly on the lake and possibly a small amount of surface runoff, all runoff from the adjacent drainage area is intercepted by major Baltimore City storm drainage systems and diverted below the lake into Gwynns Run.

e. Downstream Channel. Gwynns Run downstream from the embankment is bounded by Dukeland Street on the east and Hanlon Park on the west until it is directed into a semi-elliptical conduit at Gwynns Falls Parkway. South of Gwynns Falls Parkway is a densely populated residential area.

3.2 Evaluation. Dense vegetation on the downstream slope, including trees with diameters up to 6 inches, made inspection of the embankment difficult. The vegetation should be cut regularly to facilitate inspection of the embankment. A Registered Professional Engineer experienced in dam design and construction should be retained to evaluate the need of removing trees which have a diameter greater that 4 inches. If removal is recommended, the engineer should recommend a method of root removal and refill to prevent the formation of voids in the embankment caused by root decomposition. The condition of the appurtenant structures is considered to be fair, but the condition of the dam embankment is poor due to the three seepage areas noted near the toe of the southern embankment. A Registered Professional Engineer experienced in dam design and construction should be retained to investigate the three observed seepage areas, to determine the source of the seeps, and to recommend corrective measures that will eliminate or control the seepage.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. There are no control valves on the conduit which conveys wash water from the Ashburton Water Purification Plant into the wash water lake, consequently, the inflow can only be controlled by operations at the plant. The water level in the lake is normally maintained at elevations between 304 and 308, from 2 to 6 feet below the 310 crest elevation of the overflow structure, by opening the upper level gate of the overflow structure.

4.2 Maintenance of the Dam. The maintenance of the dam embankment is considered poor as evidenced by the three seepage zones noted at or near the toe of the downstream slope. It is apparent that the downstream slope of the southern embankment is not maintained because of the density of the vegetation.

4.3 Maintenance of Operating Facilities. The operation of the upper level gate in the overflow structure is satisfactory. The gate is operated 3 or 4 times a month to regulate the water level in the lake. The lower level gate, according to personnel at the Ashburton plant, is operable, but it is covered by plant sludge and it has not been opened for several years.

4.4 Warning System. No formal warning system exists for the dam. Telephone communication facilities are available from the Ashburton Pumping Station to the west and from the purification plant to the northeast.

4.5 Evaluation. The maintenance of the appurtenant structures is considered satisfactory, but the maintenance of the embankment is considered poor due to the dense vegetation on the downstream slope and the three seepage areas noted near the toe of the southern embankment. It is recommended that the Owner regularly cut the vegetation to facilitate inspection of the embankment. The Owner should retain a Registered Professional Engineer experienced in dam design and construction to evaluate the need of removing trees from the embankment which have diameters greater than 4 inches. If removal is recommended, the P. E. should recommend a method of root removal and refill to prevent the formation of voids in the embankment caused by root decomposition. A P.E. should also investigate the three seepage areas to determine the source of the seeps and to recommend corrective measures that will eliminate or control the seepage.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. Original design data for the hydraulics and hydrology of Peck's Branch are not available. A tabulation of reservoir storage versus pool elevation is included as Page D-2 of Appendix D.

Because all inflow to the wash water lake, with the exception of rainfall on the lake, is controlled by the operations at the Ashburton Water Purification Plant, hydraulic and hydrologic analyses have not been performed. The hazard classification for this impoundment is considered high because a residential area could be flooded if the dam failed.

b. Experience Data. The reservoir water levels are not monitored by instrumentation, but are visually inspected periodically.

There is no information that would indicate that there has ever been a problem with Peck's Branch storing or passing rainfall from severe storms including hurricanes

c. Visual Observations. Visual examination of the embankment, appurtenant structures, and downstream floodplain indicate that there are no problems with the hydraulic and hydrologic aspects of Peck's Branch Dam.

d. Overtopping Potential. No evidence exists that Peck's Branch Dam ever overtopped or has been in danger of overtopping. The hydrologic and hydraulic calculations in Appendix D indicate that the dam would not be overtopped following a storm having an intensity equal to the Probable Maximum Precipitation. Inflow to the impoundment can be controlled by adjustments in operational modes of the Ashburton Water Purification Plant. Lowering the reservoir level can be accomplished by opening the upper level sluice gate located in the drop inlet spillway. The lower level sluice gate is operable, but it is currently covered by plant sludge.

e. Spillway Adequacy. The existing overflow structure (drop inlet spillway) and outlet works is considered adequate for the manner in which the reservoir is operated. If it is arbitrarily assumed that the overflow structure did not function during the occurence of a 100 percent Probable Maximum Flood (PMF) event, Appendix D computations demonstrate that all uncontrolled inflow to the lake during this event could be contained within the impoundment with about 0.8 feet of freeboard remaining between the PMF pool level and the top of the dam.

f. Downstream Channel. In the event of dam failure, the culvert carrying Gwynns Run under the Gwynns Falls Parkway could carry the flood water if it does not become obstructed. If flow through the culvert became obstructed, however, the residential area downstream of Gwynns Falls Parkway could be flooded. A high hazard classification is therefore warranted for Peck's Branch Dam.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) Embankment. The only features suggesting potential problems with embankment integrity were the three seepage zones noted on the downstream slope of the southern embankment. None of the seepage areas appeared to be carrying significant amounts of sediment, and there was no surficial evidence of soil loss upslope from the seepage zones. However, the magnitude of seepage from the right abutment is significant enough to possibly affect the structural stability of the dam by causing internal piping.

(2) Appurtenant Structures. The appurtenant structures consisting of the overflow structures and the semi-elliptical drain show no signs of distress.

b. Design and Construction Data.

(1) Embankment. Contract Drawings of Peck's Branch Dam dated June 1953 are available, however no stability analyses were located. The dam was completed in 1956 but, based on the "Annual Report of the Department of Public Works" of the City of Baltimore dated 1956, before the end of the year water was noted seeping through the southern embankment. The report indicates that the problem was remedied by injecting cement grout into the embankment along a line starting at the right wall of the overflow structure and extending to the right to the toe of the Lake Ashburton embankment.

(2) Appurtenant Structures. Details of the overflow structure and drain are shown on the available contract drawings, but no design calculations or construction records are available.

c. Operating Records. No formal operating records are maintained at the Ashburton Water Purification Plant. The water level in the wash water lake is controlled by adjustments of the upper level gate of the overflow structure on an as needed basis.

d. Post Construction Changes. Other than the grouting that was done in 1956 as described above in section 6.1 b(1), there are no available records of any post construction changes involving the embankment or appurtenant structures.

e. Seismic Stability. Peck's Branch Dam is located in Seismic Zone 1. Based on the visual observations, the static stability of the dam appears to be adequate. Consequently, the dam should present no hazard from earthquakes.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Assessment. Peck's Branch Dam is an intermediate size, high hazard impoundment. A dense residential area is located downstream of the inlet to the Gwynns Run culvert, approximately 2000 feet downstream of the dam. The culvert is large enough to handle the increased flow resulting from a dam failure, but if the inlet became obstructed during the increased flow, flooding would result which could overtop Gwynns Falls Parkway and flood the residential area. Because essentially all inflow into the wash water lake is controlled by operations at the Ashburton Water Purification Plant, and because personnel from the plant regularly adjust the gate in the overflow structure to maintain the water level from 2 to 6 feet below the overflow elevation of +310, the hydraulic and hydrologic aspects of the project are not significant.

b. Adequacy of Information. The available information, consisting of the contract drawings for Peck's Branch Dam, is considered adequate for the Phase I Report.

c. Urgency. Due to the number and magnitude of seepages noted at or near the downstream toe of embankment, the investigation described below in the "Need for Additional Data" should be conducted immediately.

d. Need for Additional Data. We recommend that the Owner retain a qualified Registered Professional Engineer experienced in the design and construction of earth and rockfill dams to conduct an investigation to determine the source of the seeps noted along the southern embankment, and to recommend a means of controlling the seeps. We recommend that the investigation be performed immediately.

7.2 Recommendations/Remedial Measures.

The following remedial measures are recommended to be accomplished by the Owner:

a. Retain the services of a Registered Professional Engineer experienced in the design and construction of embankment dams to investigate the three observed seepage areas, to determine the source of the seeps, and to recommend corrective measures that will eliminate or control the seepage.

b. Retain the services of a Registered Professional Engineer experienced in the design and construction of embankment dams to evaluate the need to remove the trees having diameters greater than 4 inches that are growing on the embankment. If removal is recommended, the P.E. should also recommend a method of root removal and refill to prevent the formation of voids in the embankment caused by root decomposition.

c. The brush, woody vegetation, and small trees growing on the embankment slopes should be removed, and future growth controlled.

d. Schedule formal periodic inspections of the dam embankment and appurtenant structures.

e. Develop a formal warning system to alert downstream residents in the event of emergencies.

APPENDIX A

VISUAL INSPECTION CHECKLIST

PHASE I

APPENDIX A
VISUAL INSPECTION CHECKLIST
PHASE I

Name of Dam: Peck's Branch County (or City): Baltimore City State: Maryland

NDI ID. No.: MD- 23 Type of Dam: Earth Hazard Category: High

Date(s) Inspection: 5/29/80 & 7/15/80 Weather: Clear Temperature: 80's

Pool Elevation at Time of Inspection: 306± M.S.L. Tailwater at Time of Insp. 250± M.S.L.

Inspection Personnel:

J. D. Nouman

A. Zamboky

Review Inspection Personnel:

E. J. Zeigler

J. G. Mintiens

J. D. Nouman

J. D Nouman Recorder

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Some erosion resulting from small stream flowing from seepage zone along right abutment of dam	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment satisfactory Vertical alignment varies 2.5 Feet.	The low point on the crest is elevation 312.9, which is 0.1' below the design crest elevation of 313.
RIPRAP FAILURES	Riprap constructed from elevation 309 up to 311±, design water level is 310. No failures noted.	

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Seepage zone noted along right abutment of dam. Estimated flow rate 15 gpm	Retain professional engineer experienced in dam design to determine source and means of controlling seep
ANY NOTICEABLE SEEPAGE	Three locations: 1) Left of & adjacent to outlet conduit (est. 5 gpm) 2) Along right abutment (est. 15 gpm) and 3) right of outlet conduit (no measured flow)	Same recommendation as above.
STAFF GAGE AND RECORDER	None	
DRAINS	Two storm drains underlie lake and join at concrete box, single drain extends from concrete box south to overflow structure	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Minor	
INTAKE STRUCTURE (INFLUENT TO LAKE)	42-inch Ø Wash Water Drain from Ashburton Filtration Plant	
OUTLET STRUCTURE	Overflow structure located at south end of Lake, elliptical drain	
OUTLET CHANNEL	10.0 Feet by 9.75 Feet elliptical pipe	
EMERGENCY GATE	N/A	

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

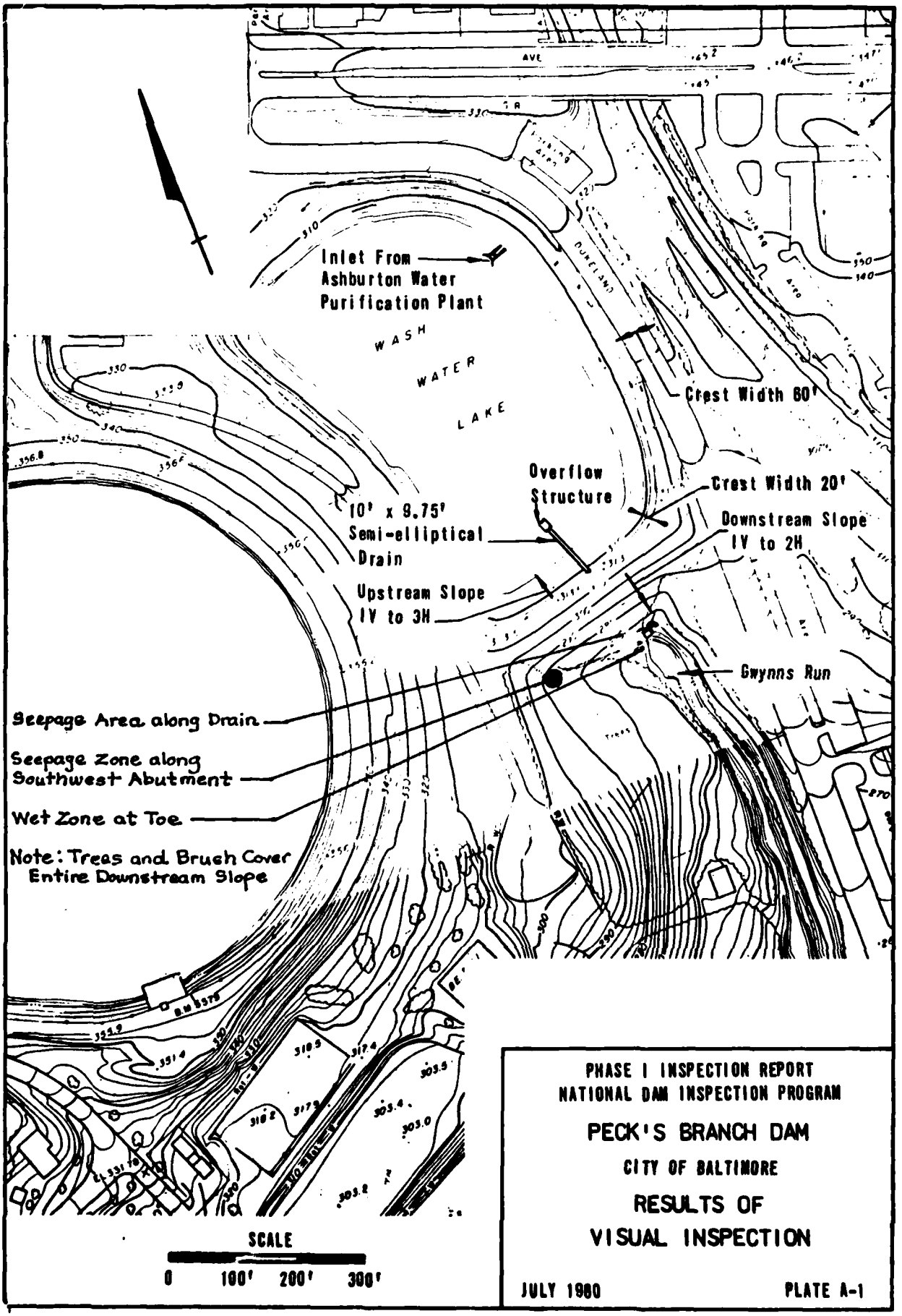
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER		

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Outer slopes 1 Vertical to 2 Horizontal Inside slopes 1 Vertical to 3 Horizontal	
SEDIMENTATION	None	
UPSTREAM RESERVOIRS	N/A	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Gwynns Run; no obstructions until elliptical conduit at Gwynns Falls Parkway	
SLOPES	Highly eroded banks in some areas, boulder-strewn. Bedrock in channel adjacent to Gwynns Falls Parkway	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Hanlon Park parallels west side of Gwynns Run, Dukeland Road on east side. Residential area downstream of Gwynns Falls Parkway	



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PECK'S BRANCH DAM

CITY OF BALTIMORE

RESULTS OF VISUAL INSPECTION

JULY 1980

PLATE A-1

APPENDIX B

ENGINEERING DATA CHECKLIST

PHASE I

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Peck's Branch

ID# 23

ITEM	REMARKS
AS-BUILT DRAWINGS	Record Contract drawings for construction of Peck's Branch Dam (Ashburton Wash Water Lake) in conjunction with construction of the Ashburton Water Purification Plant are on file with Baltimore City. Drawings are dated June, 1953.
REGIONAL VICINITY MAP	Peck's Branch is shown on essentially all maps of Baltimore City.
CONSTRUCTION HISTORY	Information available from Contract drawings.
TYPICAL SECTIONS OF DAM	A typical section of the embankment is included as Plate E-2.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	Refer to abovementioned Contract drawings.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None
DESIGN REPORTS	None
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	None
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Seepage was noted at the toe of the southern embankment in 1956, shortly after completion of construction. The seepage was stopped by injecting cement grout into the embankment along a line extending from the overflow structure to the toe of Lake Ashburton.
MAINTENANCE OPERATION RECORDS	Maintenance and Operation Records are maintained on mechanical/electrical equipment by Baltimore City, Bureau of Water and Waste Water, Water Treatment Section
SPILLWAY PLAN SECTIONS DETAILS	Refer to abovementioned Contract drawings.
OPERATING EQUIPMENT PLANS AND DETAILS	N/A

APPENDIX C

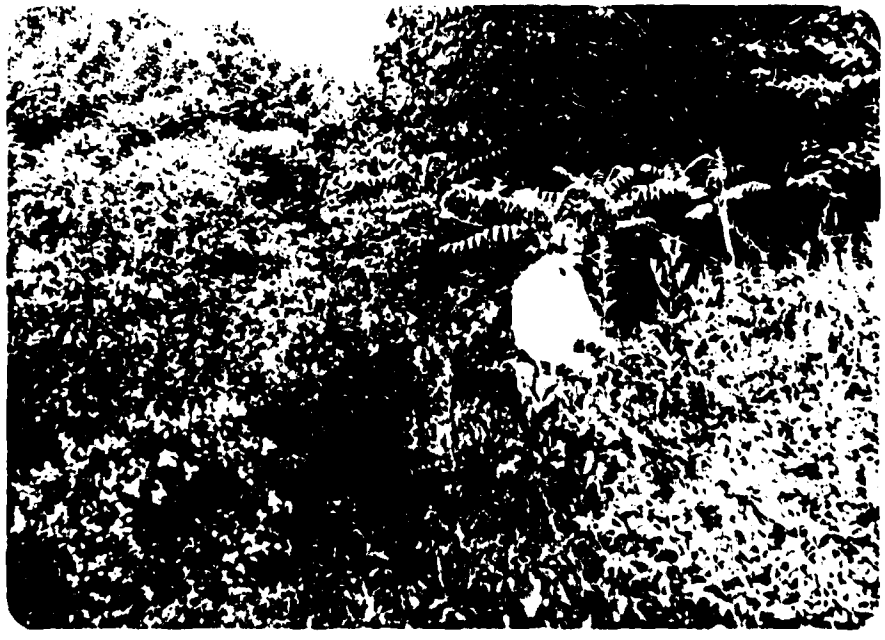
PHOTOGRAPHS

PECK'S BRANCH DAM

A. View of wash water lake from the north

B. Crest of southern embankment

C. Western Embankment and Access Road



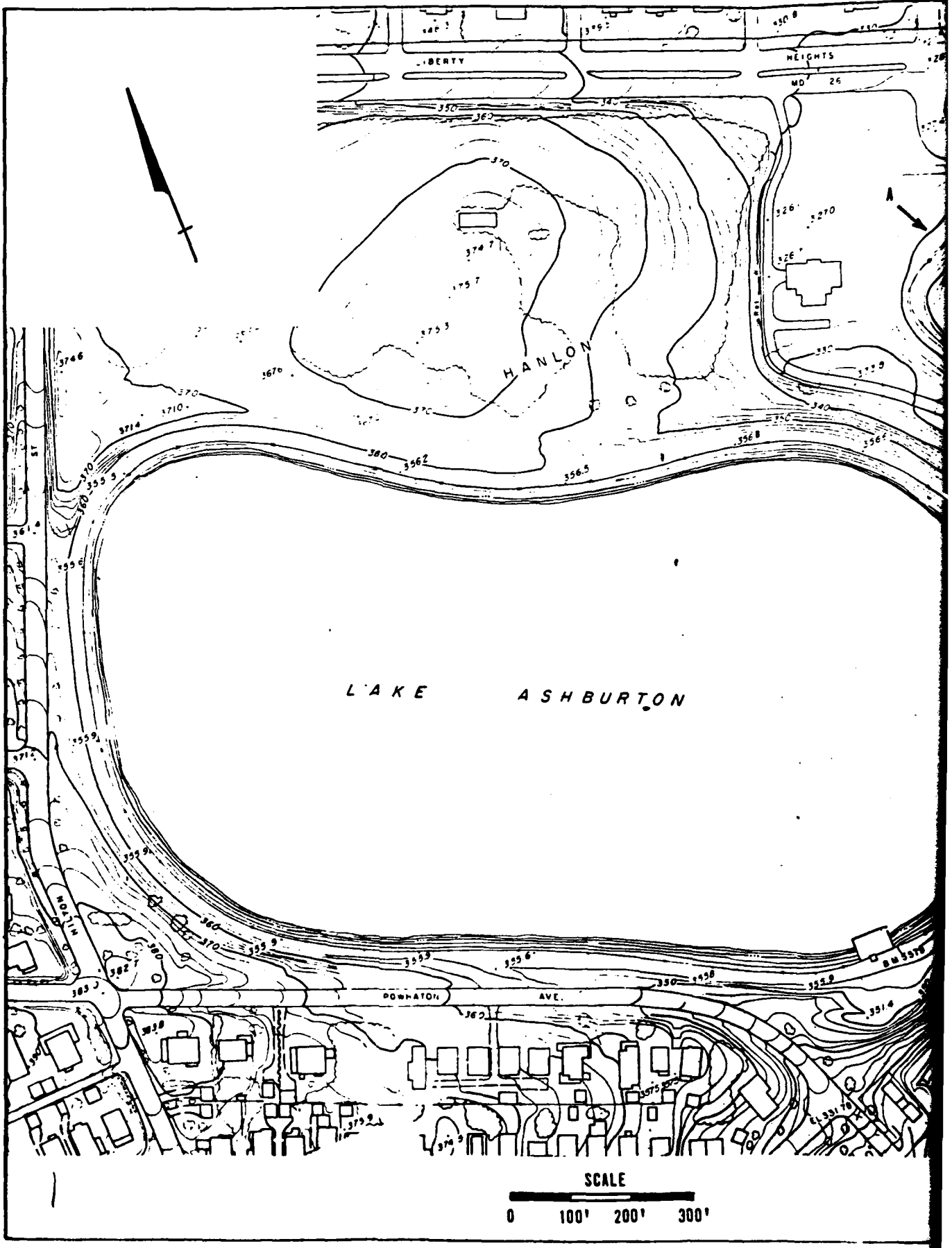
D. Heavy vegetation on downstream slope of south embankment

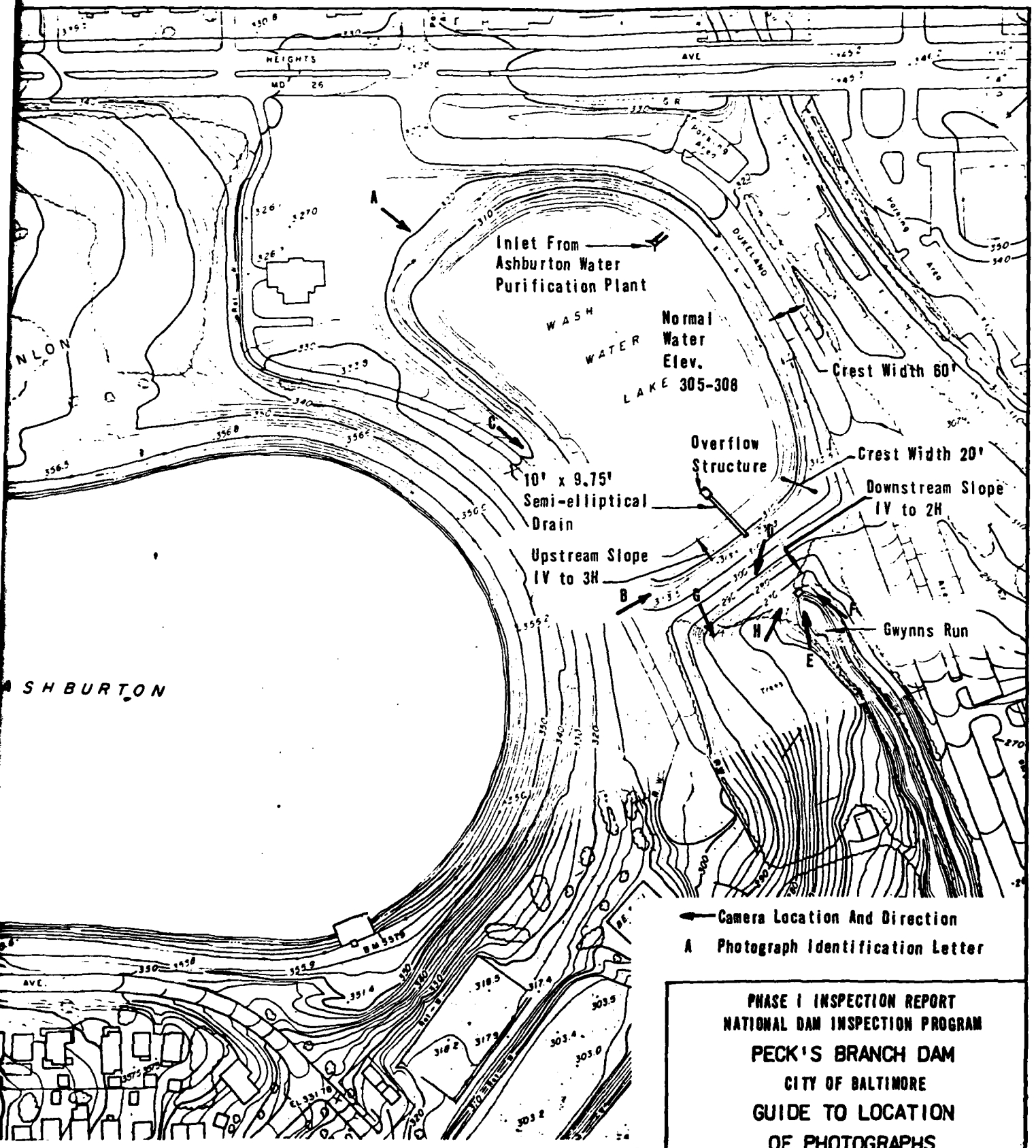
E. Elliptical outlet conduit empties into Gwynns Run

F. Seepage noted along left side of outlet conduit

G. Origin of seepage zone noted near toe of right abutment of dam

H. Water flowing from southwestern abutment seepage zone enters Gwynns Run 80± feet right of outfall conduit


LIBERTY
HEIGHTS
MD 26
HANLON
A
LAKE ASHBURTON
POWHATON AVE.
SCALE
0 100' 200' 300'



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PECK'S BRANCH DAM

CITY OF BALTIMORE

GUIDE TO LOCATION OF PHOTOGRAPHS

JULY 1980

PLATE C-1

APPENDIX D

HYDROLOGY AND HYDRAULICS

EVALUATION OF AFFECTS OF
MAXIMUM PROBABLE PRECIPITATION
UPON RESERVOIR WATER SURFACE

Name of Dam: Peck's Branch Dam (NDI-ID MD-23)

Drainage Area: (Lake Surface Area at Maximum Pool) = 0.0089 sq. miles

Unadjusted Probable Maximum Precipitation (PMP) = 24.2 inches/24 hrs. for 200 square miles

Adjusted PMP for Shape Factor for 200 Square Miles = 24.2 inches/24 hrs. x .80 = 19.4 inches/24 hours[1,2]

Adjusted PMP for Drainage Area = 19.4 x 132% = 25.6 inches/24 hours[1] for 10 square miles

(Note: PMP curves from Hydrometeorogical Report 33 do not extend beyond drainage areas of less than 10 square miles. While the lake surface area is substantially less that this value, no extension of the published curves has been attempted.)

Maximum Pool Elevation = 310 feet above m.s.l.

Pool Elevation Following Occurrence of PMP of 24 hour Duration = 310 + 2.1 feet = 312.1 feet above m.s.l.

(Note: Pool elevation derived above conservatively assumes that overflow structure is not functioning during occurrence of PMP.)

Top of Dam Elevation = 312.9 feet above m.s.l. (low point)

Remaining Freeboard = 312.9 - 312.1
= 0.8 feet

Conclusion: Dam would not be overtopped following storm having an intensity equal to PMP derived above.

[1] Hydrometeorological Report 33, U.S. Army Corps of Engineers, 1956
[2] Engineering Circular 1110-2-27, U.S. Army Corps of Engineers, August, 1966.

Tabulation of Reservoir Storage Capacity Vs. Pool Elevation[1]

Name of Dam: Peck's Branch Dam (NDI-ID MD-23)

Pool Elevation feet above m.s.l.[2]	Surface Area acres	Reservoir Storage acre-feet
273 (Reservoir Bottom)	-	0
280	-	5
285	-	15
290	-	29
295	-	48
300	-	71
304 (Normal Pool)	-	89
305	-	95
310 (Maximum Pool)	5.7[3]	123
312.9 (Top of Dam)	6.0[3]	141[4]

---

[1] Source: Contract Drawing C-4, Ashburton Filtration Plant, City of Baltimore, Department of Public Works, Bureau of Water Supply, June, 1953.

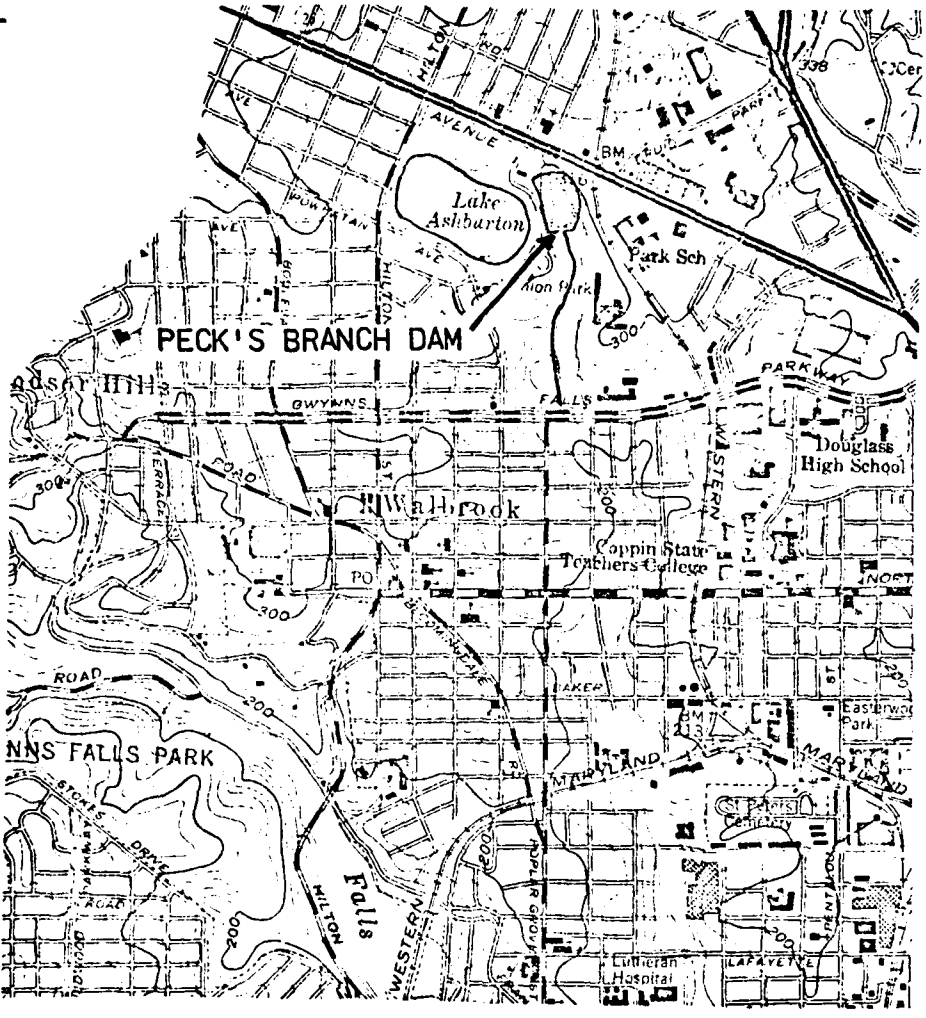
[2] Baltimore Topographical Survey Datum

[3] Area planimetered from a reduction of above referenced Contract Drawing C-4.

[4] Computed by Rummel, Klepper & Kahl.

APPENDIX E

PLATES



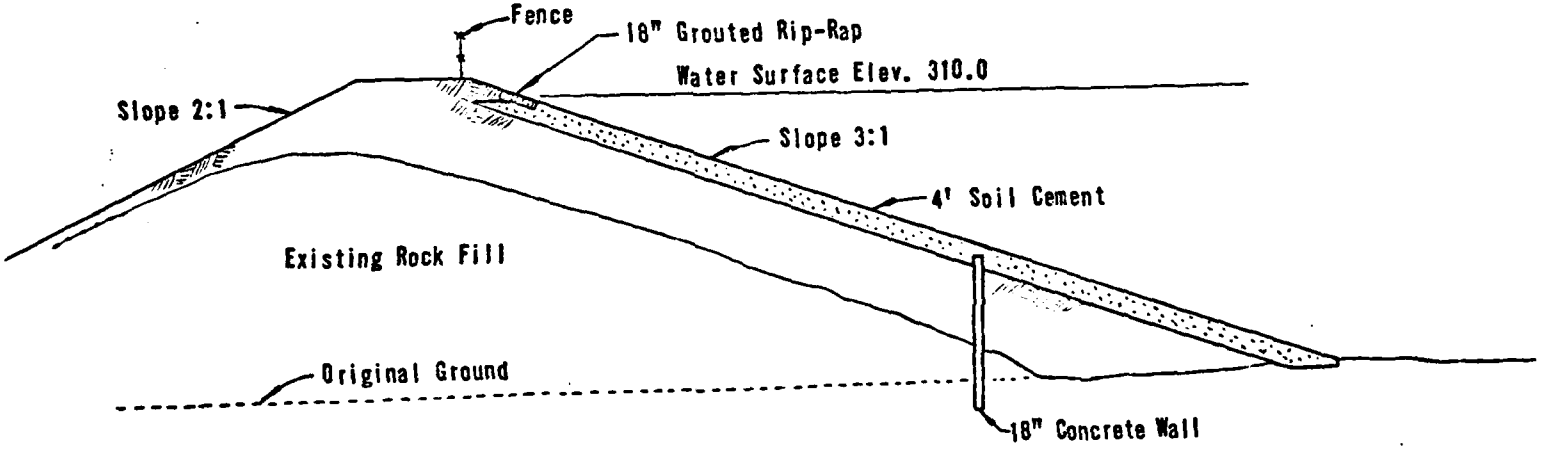
SCALE

0 ½ MI. 1 MI.

PECK'S BRANCH DAM

LOCATION MAP

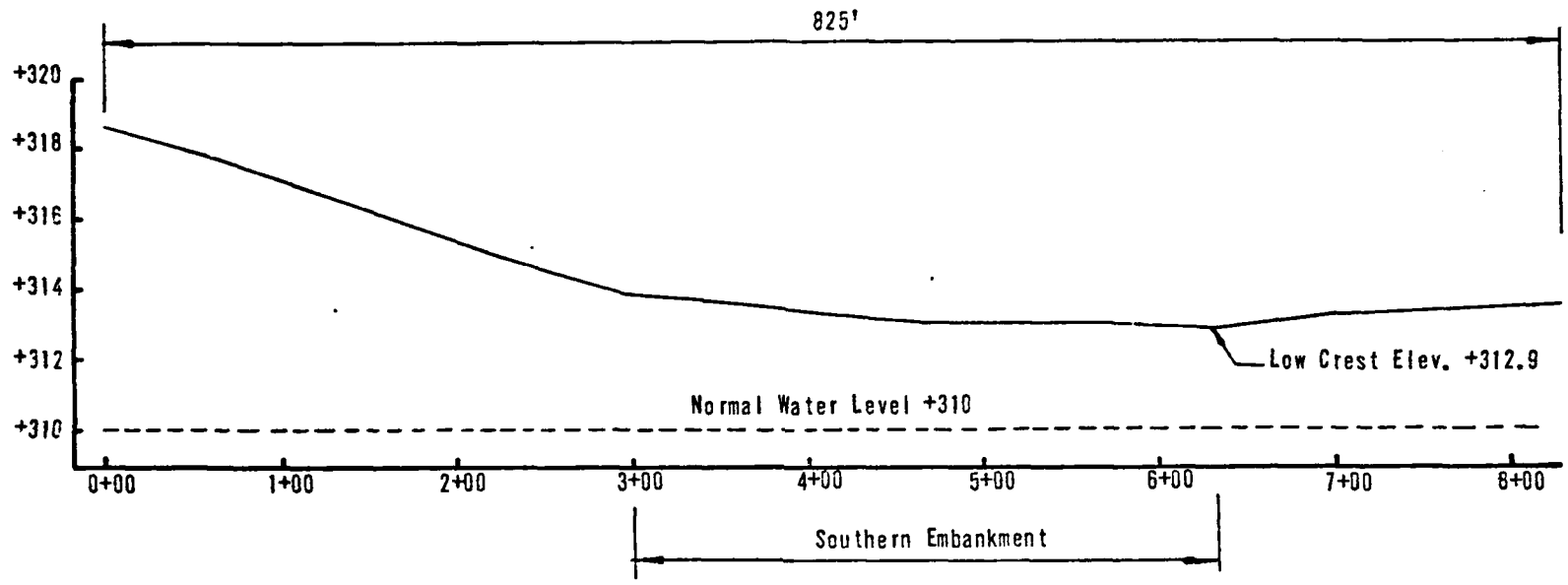
PLATE E-1



Scale 1" = 20'

TYPICAL SECTION
PECK'S BRANCH DAM
FROM DESIGN DRAWING
DATED JUNE 1953
SHEET 20

PLATE E-2



DAM CREST PROFILE

(LOOKING DOWNSTREAM)

NOTE:

DAM CREST SURVEY STATIONS ARE SHOWN ON PLATE E-4

DATUM ELEVATION IS INTERPOLATED FROM 100 SCALE PHOTOGRAMMETRY OBTAINED FROM THE CITY OF BALTIMORE.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

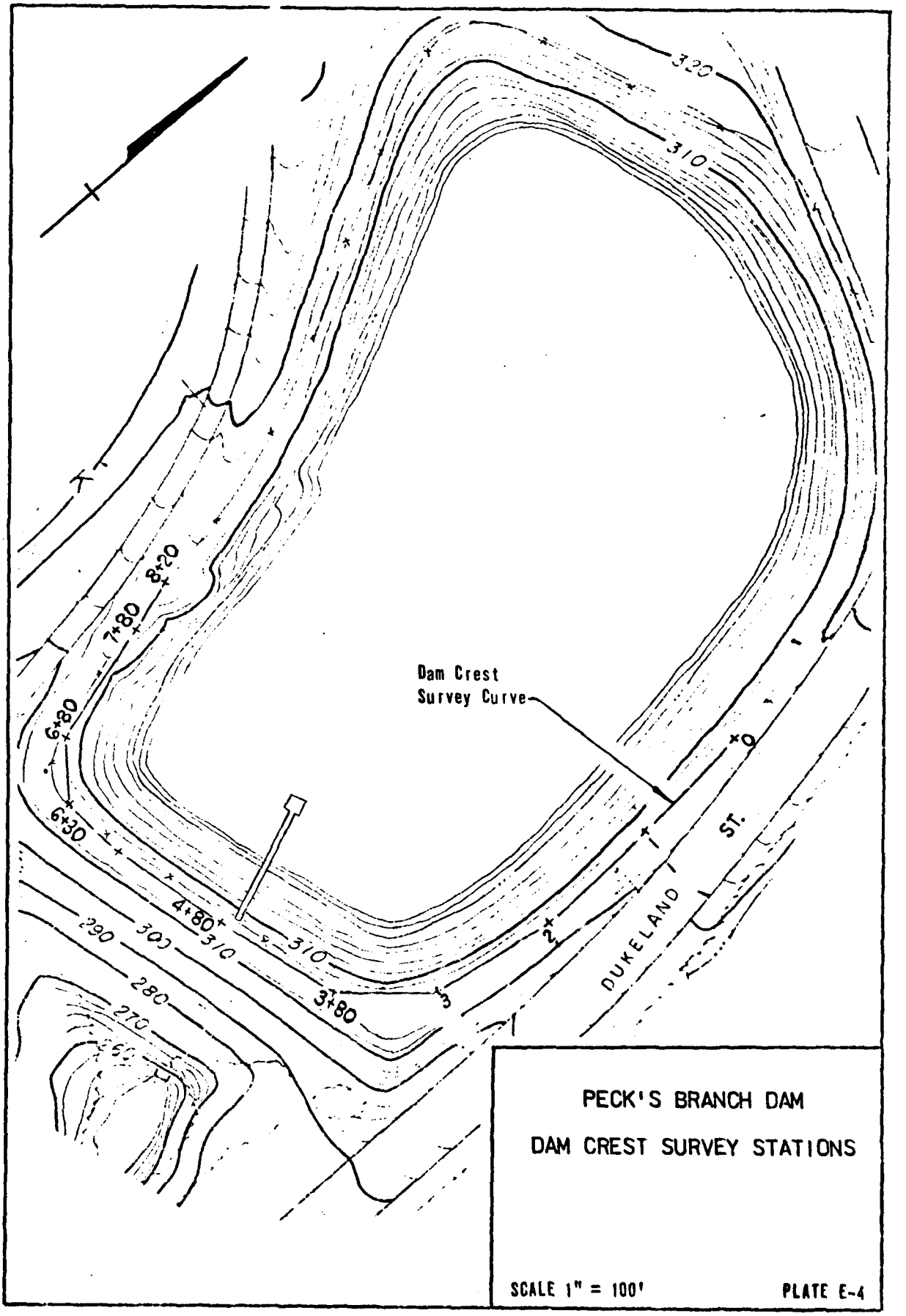
PECK'S BRANCH DAM

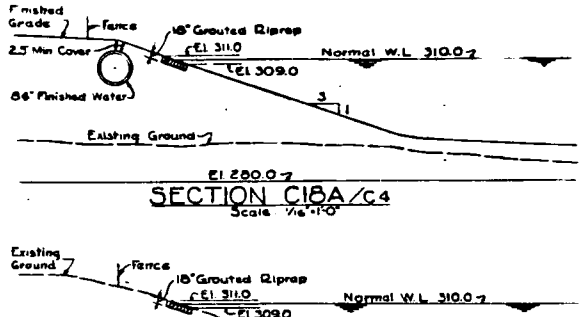
CITY OF BALTIMORE

DAM CREST SURVEY

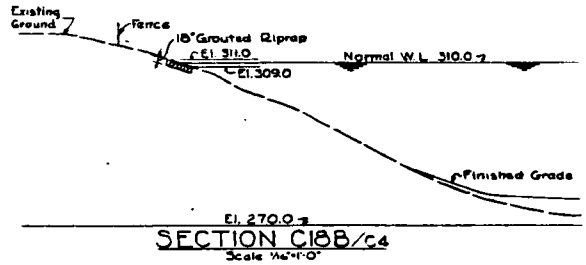
JULY 1980

PLATE E-3

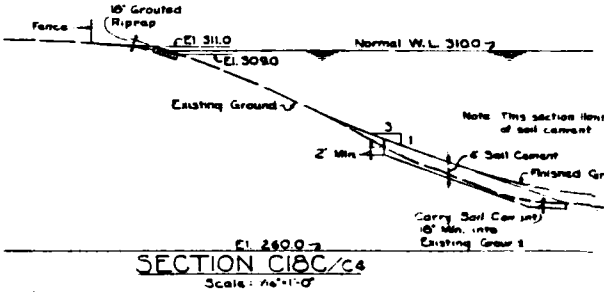

320
310
8+20
7+80
6+80
6+30
4+80
3+80
2+
1+
0
310
310
300
290
280
270
Dam Crest
Survey Curve
DUKELAND
ST.
PECK'S BRANCH DAM
DAM CREST SURVEY STATIONS
SCALE 1" = 100'
PLATE E-4



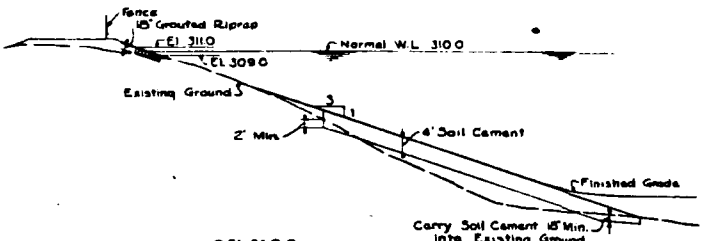
SECTION C18A/C4
Scale: 1/16"=1'-0"



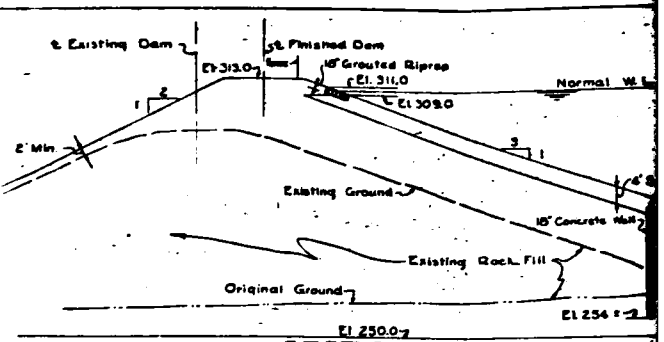
SECTION C18B/C4
Scale: 1/16"=1'-0"



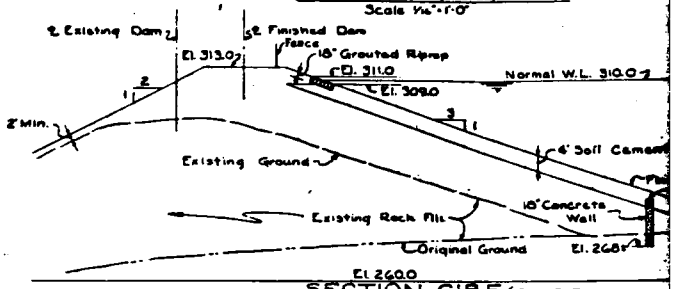
SECTION C18C/C4
Scale: 1/16"=1'-0"



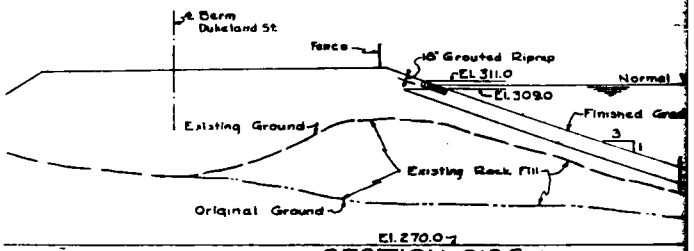
SECTION C18D/C4
Scale: 1/16"=1'-0"



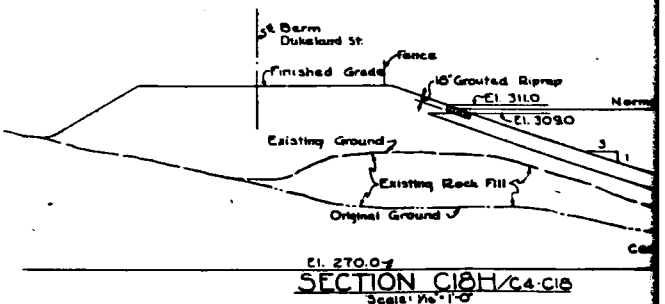
SECTION C18E/C4 C18
Scale: 1/16"=1'-0"



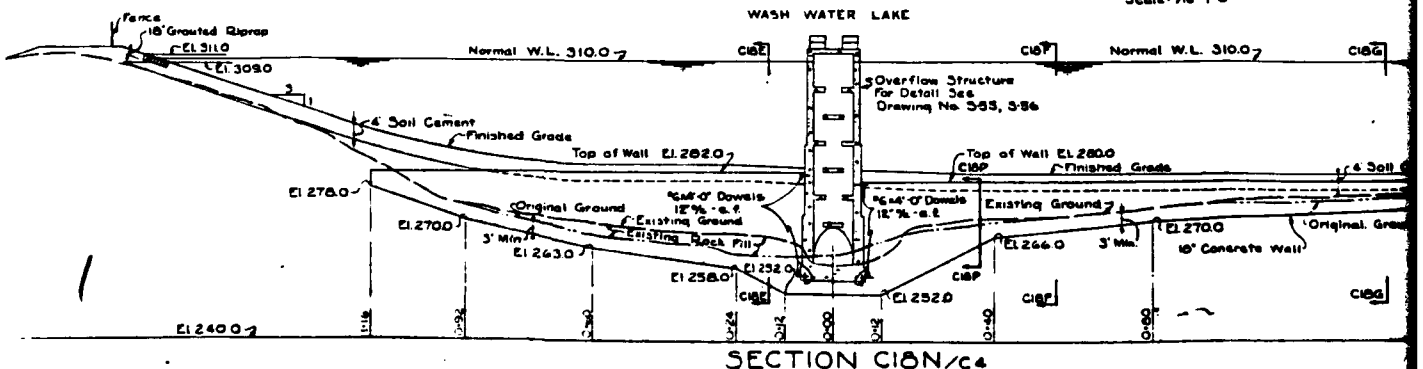
SECTION C18F/C4-C18
Scale: 1/16"=1'-0"



SECTION C18G/C4-C18
Scale: 1/16"=1'-0"



SECTION C18H/C4-C18
Scale: 1/16"=1'-0"



SECTION C18N/C4
Scale: 1/16"=1'-0"

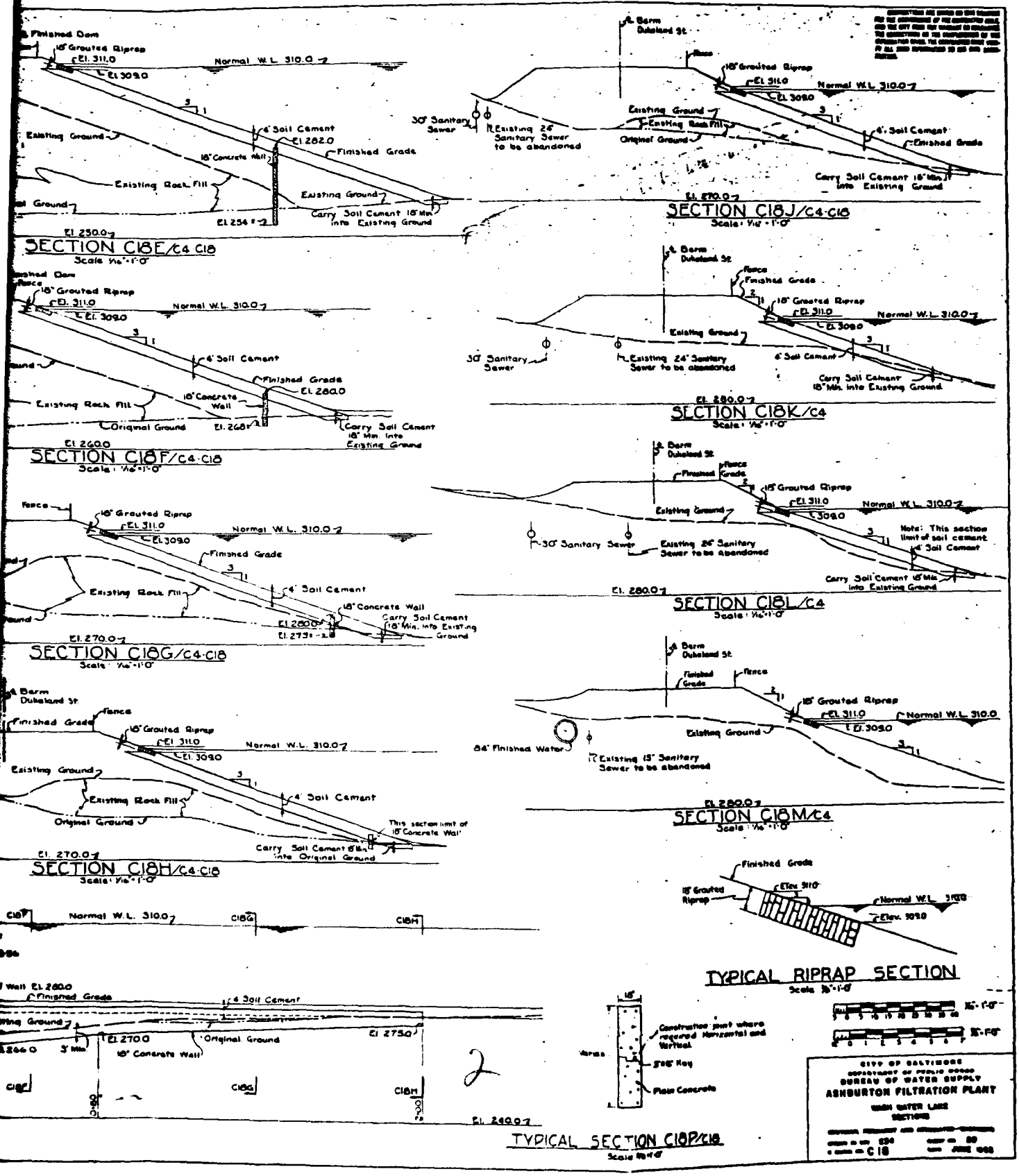
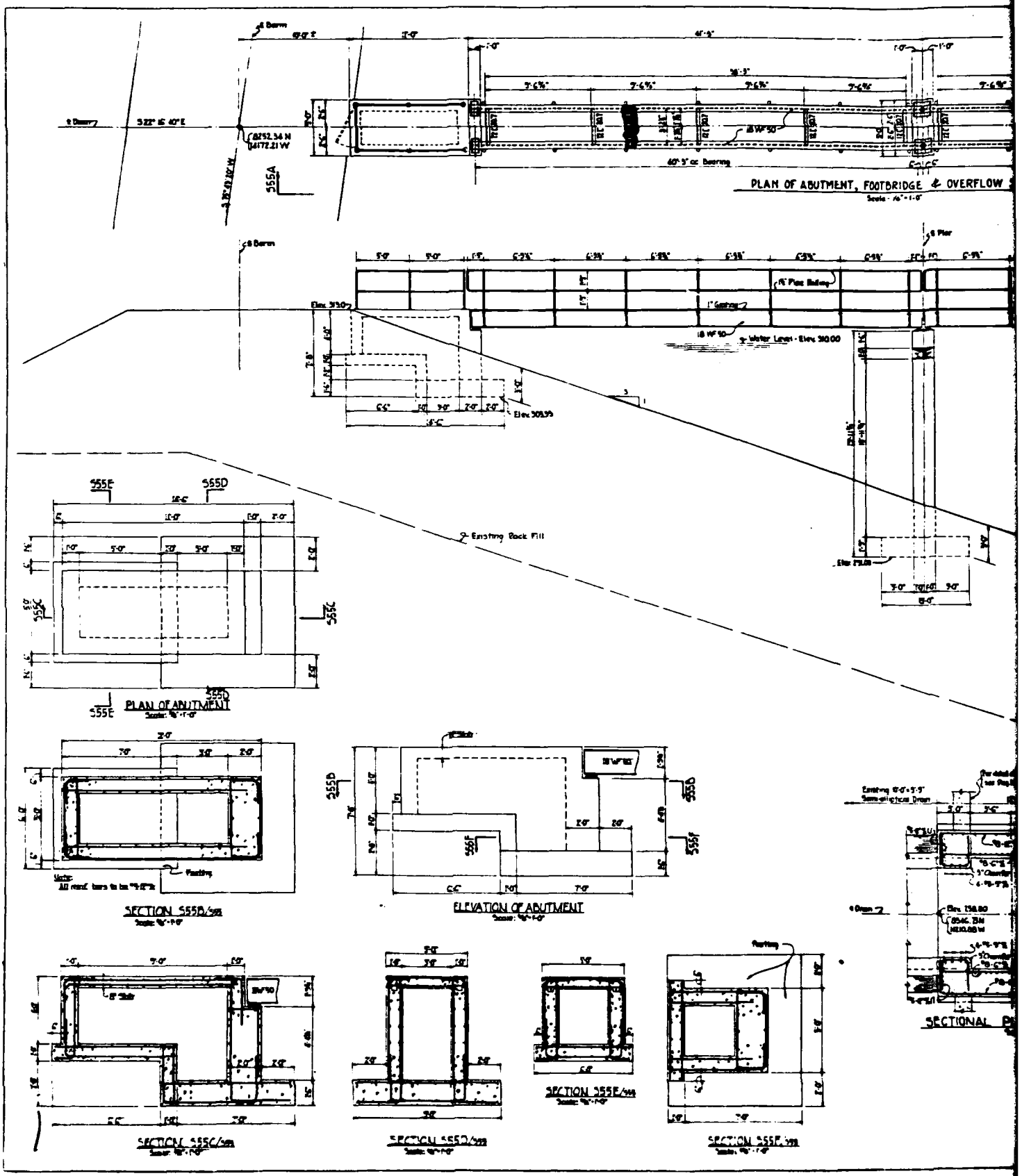

Finished Dam
18" Grouted Riprap
El. 311.0
El. 309.0
Normal W.L. 310.0
3
1
4' Soil Cement
El. 282.0
Finished Grade
18" Concrete Wall
Existing Ground
Existing Rock Fill
Carry Soil Cement 18" Min. into Existing Ground
El. 254 ±
El. 250.0
SECTION C18E/C4 C18
Scale 1/16"=1'-0"
Berm
Dukeland St.
Fence
30" Sanitary Sewer
Existing 24" Sanitary Sewer to be abandoned
Original Ground
El. 270.0
SECTION C18J/C4-C18
Scale 1/16"=1'-0"
Finished Grade
El. 280.0
SECTION C18K/C4
Scale 1/16"=1'-0"
Carry Soil Cement 18" Min. into Existing Ground
El. 260.0
SECTION C18F/C4-C18
Scale 1/16"=1'-0"
Existing 24" Sanitary Sewer to be abandoned
Note: This section limit of soil cement
SECTION C18L/C4
Scale 1/16"=1'-0"
El. 270.0
SECTION C18G/C4-C18
Scale 1/16"=1'-0"
84" Finished Water
Existing 15" Sanitary Sewer to be abandoned
SECTION C18M/C4
Scale 1/16"=1'-0"
SECTION C18H/C4-C18
Scale 1/16"=1'-0"
Elev. 310'
Elev. 309.0
TYPICAL RIPRAP SECTION
Scale 3/8"=1'-0"
Construction joint where required Horizontal and Vertical
3'x6" Key
Plain Concrete
TYPICAL SECTION C18P/C18
Scale 1/4"=1'
CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF WATER SUPPLY
ASHBURTON FILTRATION PLANT
MAIN WATER LINE SECTIONS
C 18

PLATE E-5


PLAN OF ABUTMENT, FOOTBRIDGE & OVERFLOW
Existing Rock Fill
PLAN OF ABUTMENT
SECTION 555D/555E
ELEVATION OF ABUTMENT
SECTION 555C/555
SECTION 555D/555
SECTION 555E/555
SECTION 555F/555
SECTIONAL

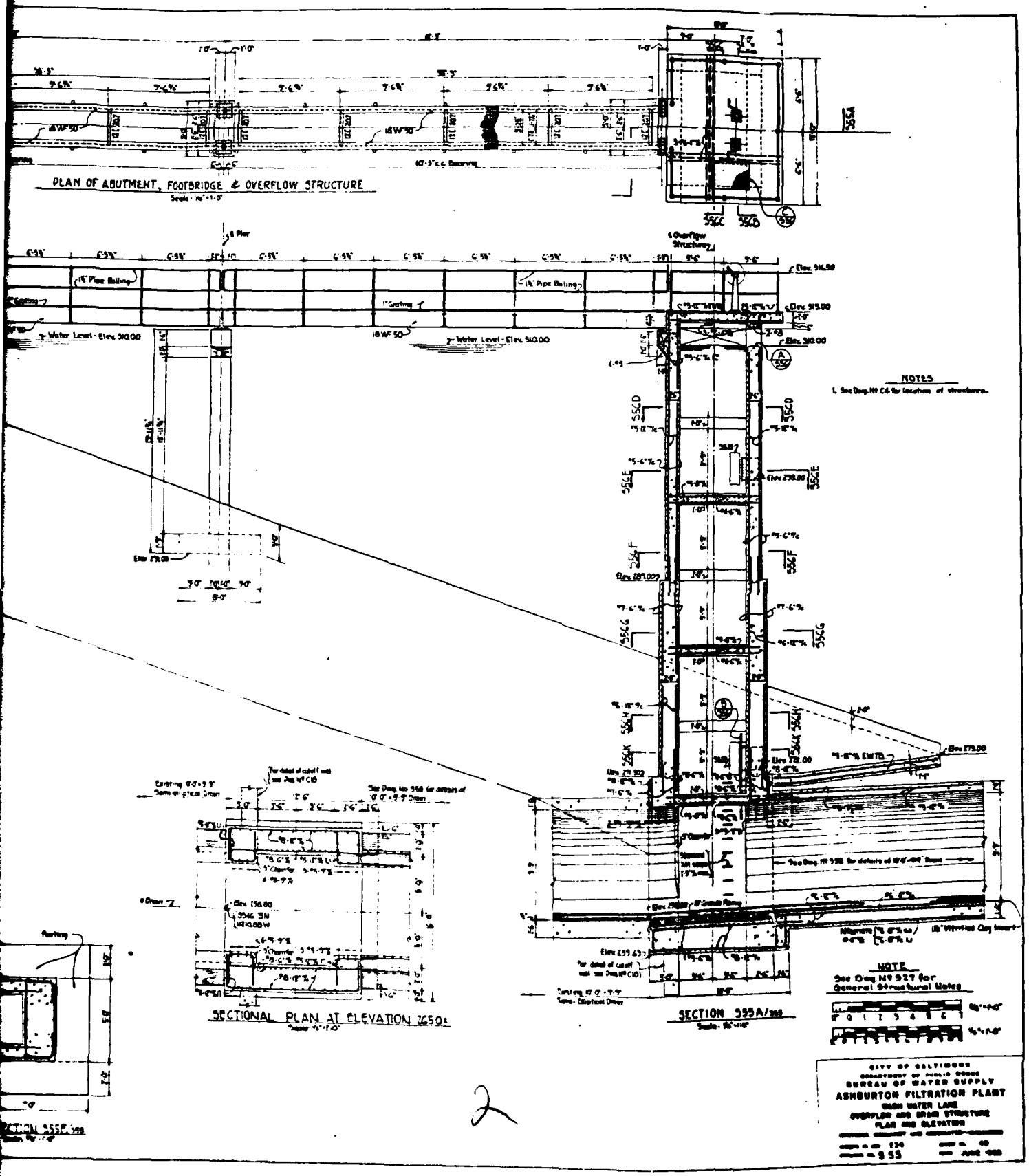
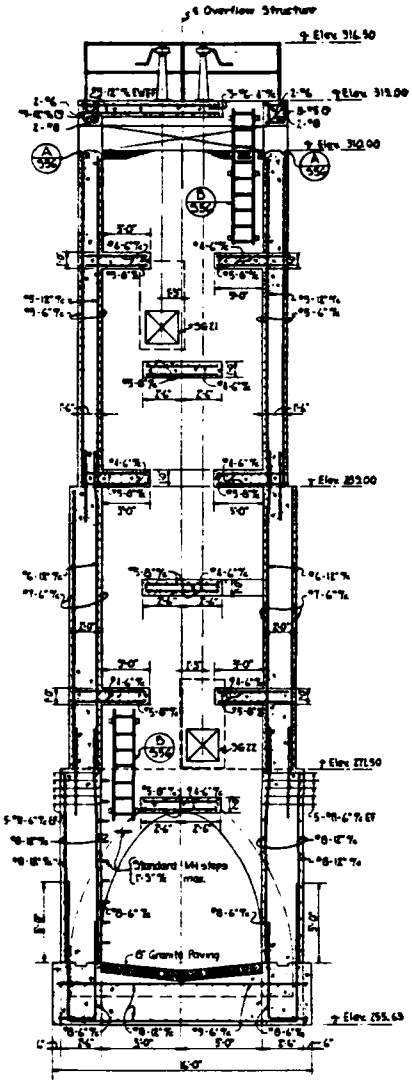
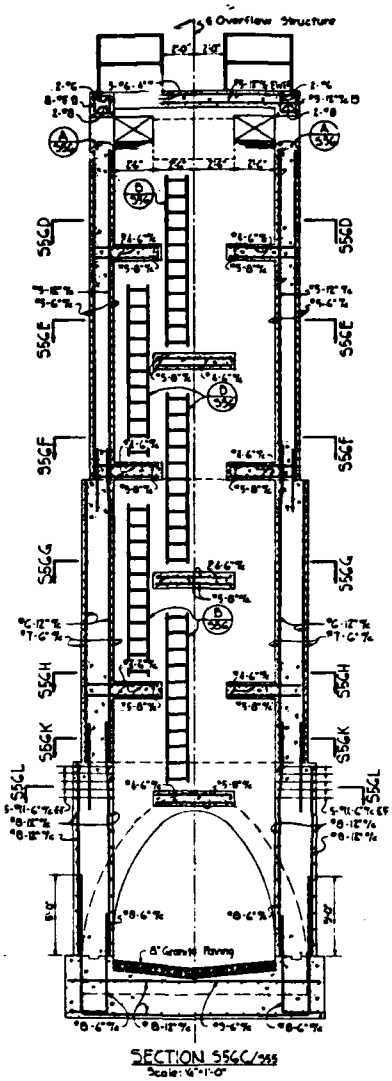

PLAN OF ABUTMENT, FOOTBRIDGE & OVERFLOW STRUCTURE
NOTES
1. See Dwg. No C6 for location of structures.
NOTE
See Dwg. No 927 for General Structural Notes
SECTIONAL PLAN AT ELEVATION 265±
SECTION 555A/555
ASHBURTON FILTRATION PLANT
HIGH WATER LAKE
OVERFLOW AND DRAIN STRUCTURE
PLAN AND ELEVATION

PLATE E-6



SECTION 556D/555
Scale: ¼"-1'-0"



SECTION 556C/555
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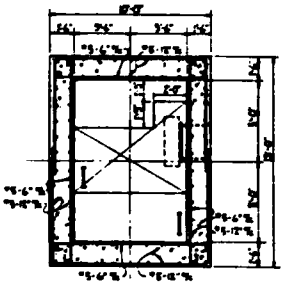

SECTION 556D/555.556
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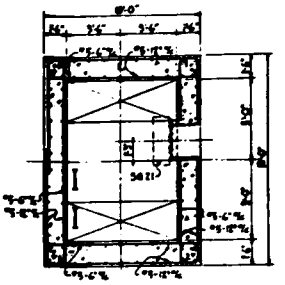

SECTION 556E 555.556
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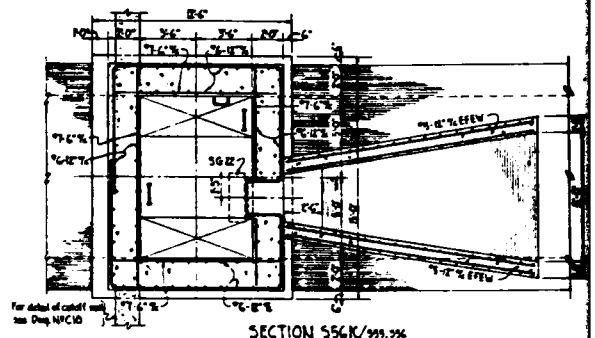

SECTION 556K/555.556
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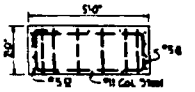
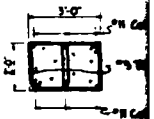
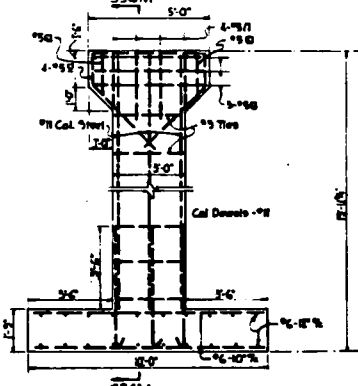


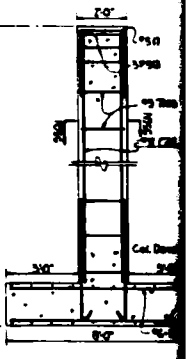
TOP PLAN OF PIER
Scale: ¾"-1'-0"



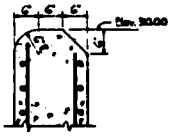
SECTION 556M
Scale: ¾"-1'-0"



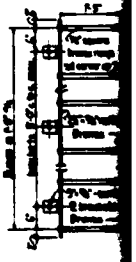
556M
ELEVATION OF PIER
Scale: ¾"-1'-0"



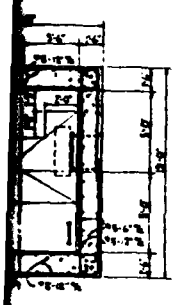
SECTION 556M
Scale: ¾"-1'-0"



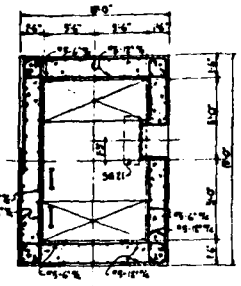
DETAIL A-556/555.556
Scale: ¾"-1'-0"



DETAIL



SECTION 556D/555.5%



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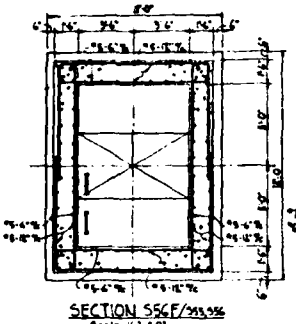

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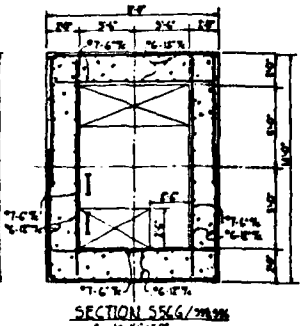

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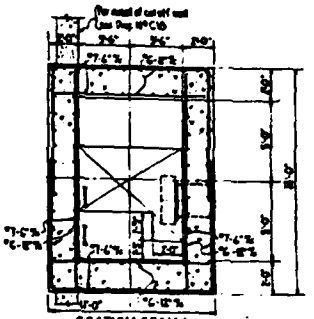

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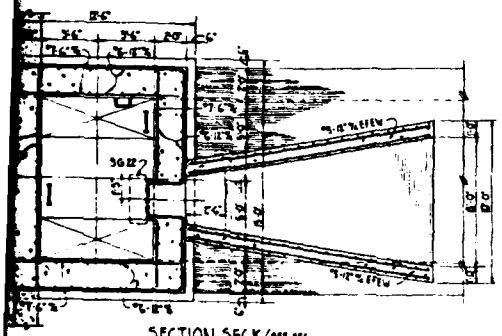

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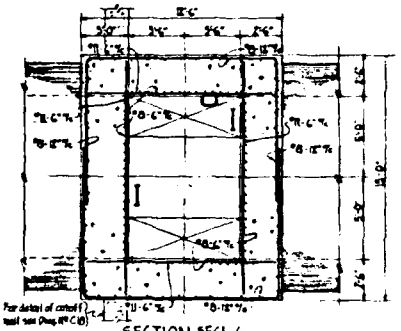
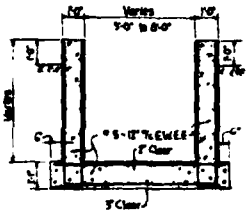
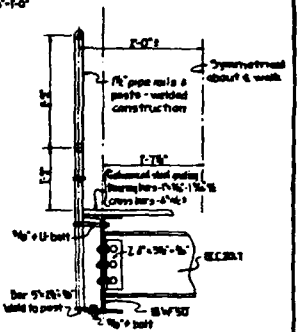


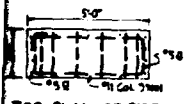
SECTION 556L/5%



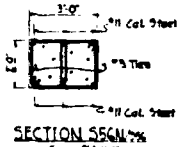
TYPICAL SECTION THRU FLUME



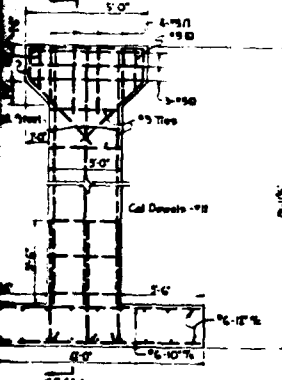
TYPICAL SECTION THRU FOOTBRIDGE



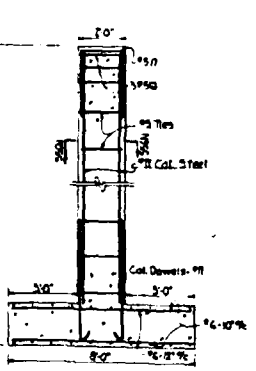
TOP PLAN OF PIER



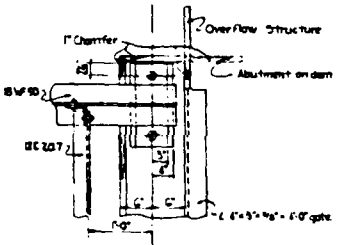
SECTION 556N/5%



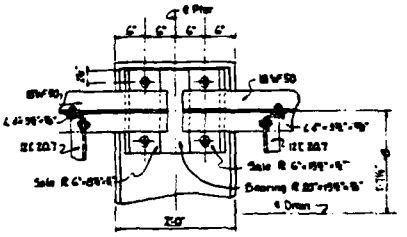
ELEVATION OF PIER



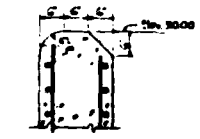
SECTION 556M/5%



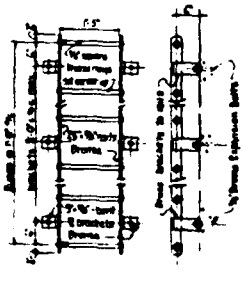
BEARING DETAIL AT ABUTMENT & AT OVERFLOW STRUCTURE



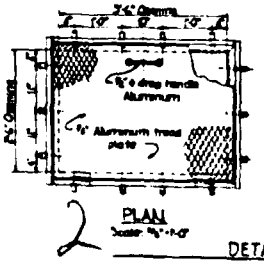
BEARING DETAIL AT PIER



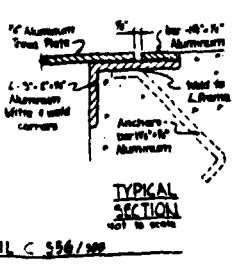
DETAIL A 556/555.5%



DETAIL B 556/555.5%



PLAN

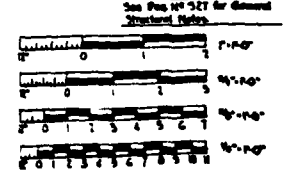


TYPICAL SECTION

DETAIL C 556/555

NOTE

See Dwg. No. 527 for General Structural Notes



CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF WATER SUPPLY

ASHBURTON FILTRATION PLANT

WASH WATER LAKE
OVERFLOW AND DRAIN STRUCTURE
SECTIONS AND DETAILS

556

JUNE 1955

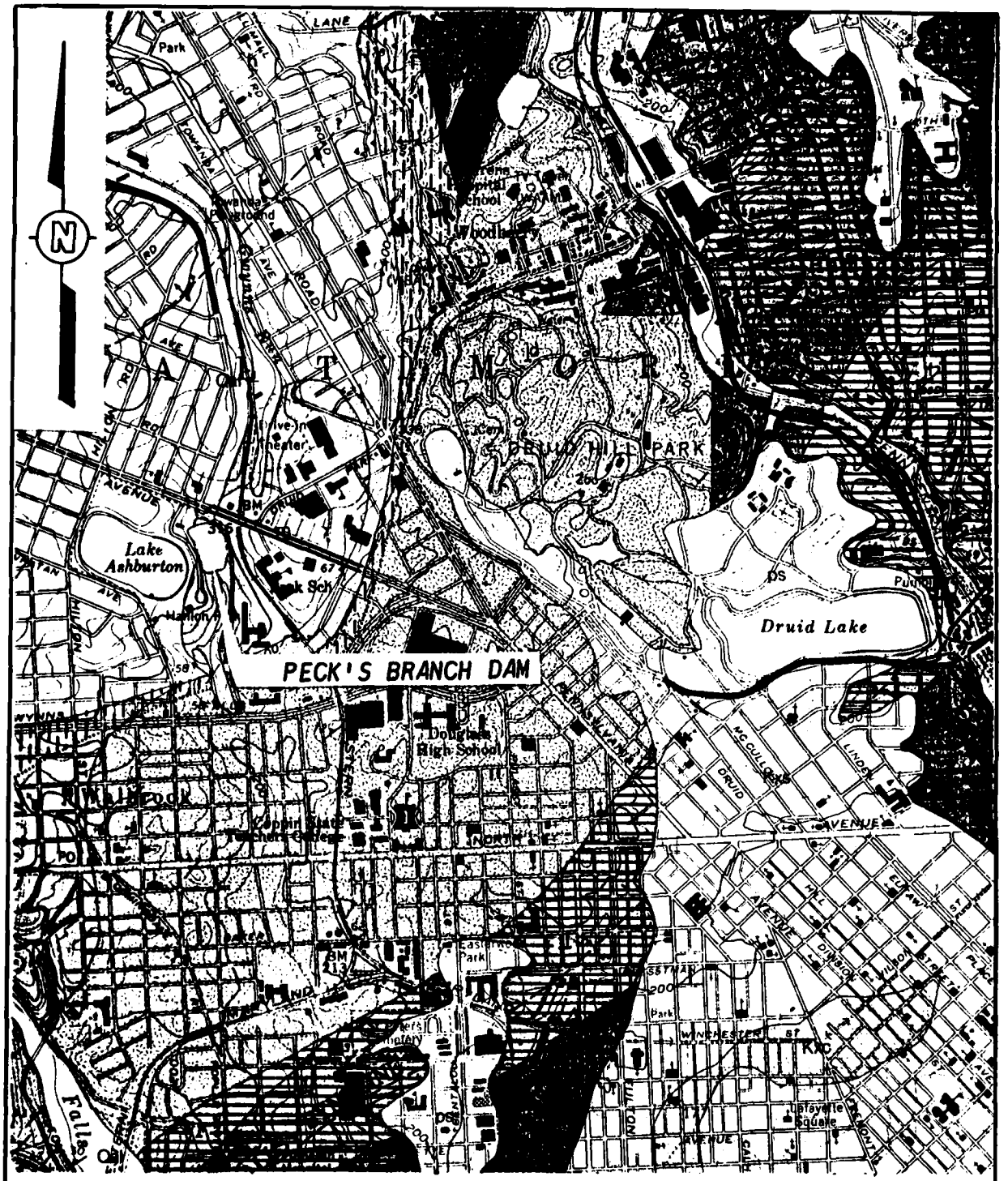
PLATE 57

APPENDIX F

GEOLOGY

PECK'S BRANCH DAM
APPENDIX F
REGIONAL GEOLOGY

The Peck's Branch Dam is located within the Piedmont Physiographic Province and is situated on a complex of residual materials derived from the in-situ decomposition of rock strata of the Mt. Washington Amphibolite. The degree of decomposition of the materials immediately beneath the dam ranges from thorough decomposition to soil-like components to partial or slight decomposition of the rock mass. The residual materials usually retain the structure and relict joint pattern of the parent amphibolite. The rock strata in the vicinity of the dam are highly jointed and dip moderately to steeply to the northwest.



SCALE

1000' 0 1000' 2000' 3000' 4000'

REFERENCE:

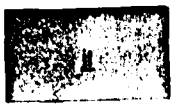
GEOLOGIC MAP OF THE BALTIMORE WEST QUADRANGLE, PREPARED BY STATE OF MARYLAND, MARYLAND GEOLOGICAL SURVEY, DATED 1979, SCALE 1" = 2000'

PECK'S BRANCH DAM

GEOLOGY MAP

RUMMEL, KLEPPER & KAHL

LEGEND



Jones Falls Schist

Medium- to coarse-grained biotite-plagioclase-muscovite-quartz schist, in places accompanied by fine-grained biotite-plagioclase-quartz gneiss in layers a few centimeters thick. Garnet, and less commonly tourmaline, occur in some outcrops. Includes very minor muscovite-plagioclase-quartz schist, quartzite, amphibolite, and muscovite-quartz-feldspar gneiss.

Artificial Fill

Consists of heterogeneous materials such as rock, unconsolidated sediment, slag, refuse, and dredge spoil. Only major areas of filled or highly disturbed ground have been mapped, such as refilled pits, diked flood plains, and transportation corridors across topographically low areas. Thickness 3 to 6 m (10 to 15 ft).

Alluvium

Interbedded gravel, sand, silt, and clay of varied composition and sorting. Typically confined to flood plains of perennial streams, upland gathering areas, and marshes adjacent to estuaries. Sediment size, sorting, and mineralogy are strongly controlled by the source rocks and geomorphic setting. The quartzose sands and polymict gravels are typically well bedded and loosely compacted; the silts and clays are often water saturated and poorly bedded. Minor amounts of colluvium (unmapped) may interfinger with alluvium at or near the bases of slopes. Structural symbols on alluvium represent bedrock exposures in stream valleys. These are typically either along the margins of the flood plain or close to the main channel of the drainage. Thickness 0.5 to 5 m (2 to 15 ft).

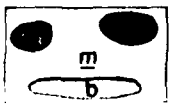
Cold Spring Gneiss

Uniform, fine- to medium-grained biotite-muscovite-microcline-quartz-plagioclase gneiss or schistose gneiss, locally devoid of muscovite. Commonly with small feldspar augen several millimeters in length and locally up to one centimeter. Age unknown.

Overprint: Cold Spring Gneiss injection complex. Areas in which the mapped rock formations include 50% or more Cold Spring Gneiss in sills up to tens of meters thick.

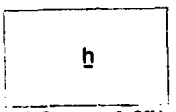
Potomac Group (?)

ps *Sand-gravel lithofacies. Poorly sorted to well sorted quartz sand containing variable amounts of vein quartz and quartzite gravel. Framework components are commonly coated with ferric oxide and are locally limonite-cemented. Varied amounts of silt and clay are present in lenses and pods and as matrix. Sand, where exposed below the soil zone, is typically planar to cross-bedded. Pebbles commonly range from 1 to 10 cm in diameter and are concentrated in coarse planar beds or are disseminated in finer sediments.*



Mount Washington Amphibolite

Fine- and medium-grained, generally massive amphibolite locally with pyroxene, and rarely with chlorite-rich zones several meters thick. Includes less than 10% actinofels and actinoschist as layers 2 centimeters or less thick, but in a few places several tens of meters thick. Serpentinite rare. Amphibolite typically uniform but locally exhibits layering on a scale of centimeters to tens of centimeters defined by variations in the amphibole/plagioclase ratio. Amphibolite locally includes irregular patches of lighter colored, coarser grained amphibolite (net veins). North of U.S. Rte. 40, generally but not invariably massive; south of U.S. Rte. 40, well foliated and not commonly massive. Where massive commonly crops out as cobbles and boulders in a clay-rich, red saprolite.



Hollofield Layered Ultramafite

Ultramafic and mafic rocks interlayered on a scale varying from centimeters to tens of meters. Chiefly actinofels and actinoschist with subordinate amphibolite and very subordinate serpentinite.

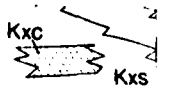
REFERENCE:

GEOLOGIC MAP OF THE BALTIMORE WEST QUADRANGLE, PREPARED BY STATE OF MARYLAND, MARYLAND GEOLOGICAL SURVEY, DATED 1979

GEOLOGY MAP LEGEND

RUMMEL, KLEPPER & KAHL

LEGEND

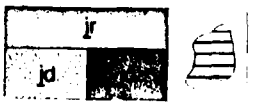


Patuxent Formation

Kxs *Sand facies. Highly variable, interbedded sand, gravel, silt, and clay containing ferruginous cements. Sand and gravel typically quartzose with a buff, kaolinitic clay-silt matrix. Sediments are organized into fining-upward packages 3 to 5 m (10 to 15 ft) thick consisting of planar-bedded gravel with clay clasts or cross-bedded sands at the base grading upward to laminated or massive silt-clay at the top. Elsewhere vertical sequences show abrupt sediment size changes and erosive contacts. The heavy mineral suite is characterized by staurolite, zircon, tourmaline, and kyanite. Sparse silicified and abundant iron-oxide replacements of both cycadioids and coniferous wood are present throughout the Formation. These sediments were deposited in a high-gradient, braided stream complex.*

Kxc *Clay facies. Light gray to black or brown clay containing variable amounts of quartz silt and gravel; local concentrations of lignitic, partially pyritized wood or macerated leaf and cone debris are associated with some siderite concretions. Thin planar beds of sand and/or gravelly clay are interbedded with massive clays. These isolated clay pods are thought to be accumulations on deflated surfaces such as abandoned stream channels or pre-Cretaceous topographic lows.*

Thickness 2 to 35 m (7 to 115 ft).



James Run Formation

jr *Relay Gneiss Member. Fine- to medium-grained biotite-quartz-plagioclase gneiss, locally containing muscovite. Mica absent and magnetite present in some outcrops. Commonly cut by numerous randomly oriented joints.*

jc *Carroll Gneiss Member. Fine- to medium-grained biotite-quartz-plagioclase gneiss, locally with muscovite. Mica absent and magnetite present in some outcrops. Includes subordinate, concordant amphibolite in layers a few centimeters to tens of centimeters thick, but locally several meters thick. Facies equivalent of Druid Hill Amphibolite Member.*

jd *Druid Hill Amphibolite Member. Fine- to medium-grained, generally well foliated amphibolite, locally with irregular anastomosing patches of coarser grained, lighter colored amphibolite. Chlorite fels and actinofels, locally foliated, associated with the amphibolite in places. Includes subordinate quartzo-feldspathic gneiss and granofels to the south which increase northward to nearly half the volume of the unit. Scale of layering ranges from a few tens of centimeters to more than 10 meters. Felsic rocks are generally fine-grained and well foliated, but may also be coarser grained, massive, and intricately jointed.*

Overprint: *Pegmatite injection complex. Areas in which the mapped rock formations include up to 50% pegmatite, identical to that described above, commonly as concordant masses a few meters thick. In places associated with a finer grained, granitic or gneissic rock with the same mineralogy.*

REFERENCE:

GEOLOGIC MAP OF THE BALTIMORE WEST QUADRANGLE, PREPARED BY STATE OF MARYLAND, MARYLAND GEOLOGICAL SURVEY, DATED 1979

GEOLOGY MAP LEGEND

RUMMEL, KLEPPER & KAHL